REMARKS

I. Introduction

In response to the pending Office Action, Applicants have amended claim 1 to further clarify the subject matter of the present disclosure and to overcome the § 112 rejections. New claim 9 has been added. Support for the amendments to claim 1 and for new claim 9 may be found, for example, in Table 1 of the specification. No new matter has been added.

Applicants appreciate the granting of an interview with the Examiner on January 11, 2011. During the interview, Applicants discussed the § 112 and § 103 rejections of claim 1. While no agreement was reached during the interview, the comments below reflect a portion of the content of the interview.

Applicants respectfully submit that all pending claims are patentable over the cited prior art for the reasons set forth below.

II. The Rejection Of Claims 1, 4 And 6 Under 35 U.S.C. § 103

Claims 1, 4 and 6 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamashita et al. (USP No. 6,287,720) in view of Fujiwara et al. (USP No. 6,576,366) and Shi et al. (US 2005/0014063), Akashi et al. (US 2003/0008212), and Miyasaka (USP No. 5,869,208); claims 1 and 4 as being unpatentable over Miyasaka in view of Nakamizo et al. (US 2001/0004502), Shi and Akashi; and claim 6 as being unpatentable over Miyasaka in view of Nakamizo, Shi and Akashi, and further in view of Susuki et al. (US 2002/0037450). Applicants respectfully traverse these rejections for at least the following reasons.

With regard to the present disclosure, amended independent claim 1 recites a cylindrical lithium secondary battery comprising a positive electrode comprising a composite lithium oxide,

a negative electrode comprising a material capable of absorbing and desorbing lithium, a separator interposed between the positive electrode and the negative electrode, and a non-aqueous electrolyte. The separator comprises a non-woven fabric having a melt-down temperature of 150℃ or more. A porous film having a thickness of not less than 0.5 μm and not more than 10 μm adheres to the surface of the positive electrode and/or the negative electrode. The non-woven fabric has a thickness of not less than 10 μm and not more than 25 μm, a total thickness of the porous film and the non-woven fabric is not less than 15 μm and not more than 30 μm. The non-woven fabric comprises an inorganic oxide filler and a binder.

One feature of the present disclosure is that the battery has both a separator comprised of a non-woven fabric having a melt-down temperature of 150℃ or more, and a porous film comprised of an inorganic oxide filler and binder. As a result of these features, the claimed battery exhibits superior safety characteristics during short circuit and anomalous heating conditions.

It is admitted that Yamashita fails to teach or suggest a separator comprised of a non-woven fabric, or that the non-woven fabric has a melt-down temperature of 150 °C or more. Fujiwara is utilized to remedy this deficiency.

Fujiwara discusses a non-woven fabric separator. However, Fujiwara only mentions the non-woven fabric in passing. Fujiwara does not use this material as a separator in the Examples. Moreover, Fujiwara and Yamashita both teach a negative electrode made of an alloy. It is well known in the art that since a negative electrode made of alloy expands and contracts greatly, short circuits occur often. Thus, one skilled in the art would not be likely to use a non-woven fabric with the alloyed negative electrode. As such, no one of skill in the art would be motivated to utilize the non-woven fabric in the battery of Yamashita. As such, the combination of

Fujiwara with Yamashita is improper. Moreover, Shi, Akashi and Miyazaka fail to remedy this deficiency.

With regard to the second § 103 rejection, as stated above, it is admitted that Miyasaka fails to specifically teach or suggest the use of a non-woven fabric in the separator. Nakazimo is utilized to remedy this deficiency. Applicants respectfully disagree.

It is stated in the Office Action on page 13 that Nakazimo discloses that non-woven fabric separators, for example, polypropylene, improve the retainment of electrolyte (see, paragraph [0008] of Nakazimo). From this paragraph, the Examiner alleges that it would be obvious to use a polypropylene separator of Nakazimo in the battery of Miyasaka. Yet, the same paragraph of Nakamizo further recites, "however, the non-woven fabric of polypropylene or polyethyleneterephthalate presented a problem of deteriorating the cycle characteristics like the microporous film". Thus, rather than providing motivation, Nakamizo actually teaches away from the use of polypropylene non-woven fabrics for use as separators. As such, the combination of Nakamizo and Miyasaka is improper.

Furthermore, the batteries of the present disclosure exhibit superior, unexpected characteristics. As is shown in Tables 1 and 2 of the specification, Example 5, which has the combination of porous film and non-woven fabric polypropylene separator, exhibits far superior nail penetration speed characteristics than Comparative Example 4, which includes a polyethylene film and a porous film. As can be seen, Example 5 shows that the temperature of the battery reached 94 °C after 90 seconds with a 5 mm/s nail speed, whereas Comparative Example 4 reached 149 °C in the same test. This is entirely unpredicted by Nakazimo.

In addition, in high temperature safety tests, in which temperatures of 150 °C at overcharge conditions are maintained for 3 hours, the surface temperature of Example 5 was 152

°C at 4.2 V, whereas Comparative Example 4 reached 160 °C with just 3.9 V. These improved characteristics are not disclosed, nor are they alluded to in any of the cited prior art. Moreover, improvement of electrolyte retention has nothing to do with these characteristics, and accordingly, Nakazimo, and any other references, would not predict these results. As such, the superior results shown in Tables 1 and 2 are indeed unexpected.

Therefore, Applicants submit that Yamashita, Nakazimo and Miyasaka do not render amended independent claim 1 obvious. Furthermore, Shi, and Fujiwara do not and are not relied upon to remedy these deficiencies.

In order to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. As is clearly shown, Yamashita, Fujiwara, Akashi, Miyasaka, Nakamizo and Shi do not disclose or suggest a cylindrical lithium secondary battery comprising: a separator interposed between said positive electrode and said negative electrode; and a non-aqueous electrolyte, wherein said separator comprises non-woven fabric, at least one of said positive electrode and said negative electrode has a porous film that is adhered to a surface thereof, said porous film has a thickness of not less than 0.5 μm and not more than 10 μm, the non-woven fabric has a thickness of not less than 10 μm and not more than 25 μm, a total thickness of the porous film and the non-woven fabric is not less than 15 μm and not more than 30 μm, and said porous film comprises alumina and a binder. Therefore, Applicants submit that Yamashita, Fujiwara, Akashi, Miyasaka, Nakamizo and Shi do not render amended independent claim 1 of the present invention obvious and accordingly, Applicants respectfully request that the § 103(a) rejection of claim 1 be withdrawn.

III. All Dependent Claims Are Allowable Because The Independent Claim From Which They Depend Is Allowable

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as independent claim 1 is patentable for the reasons set forth above, it is respectfully submitted that all pending dependent claims are also in condition for allowance.

IV. Conclusion

Having fully responded to all matters raised in the Office Action, Applicants submit that all claims are in condition for allowance, an indication of which is respectfully solicited.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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